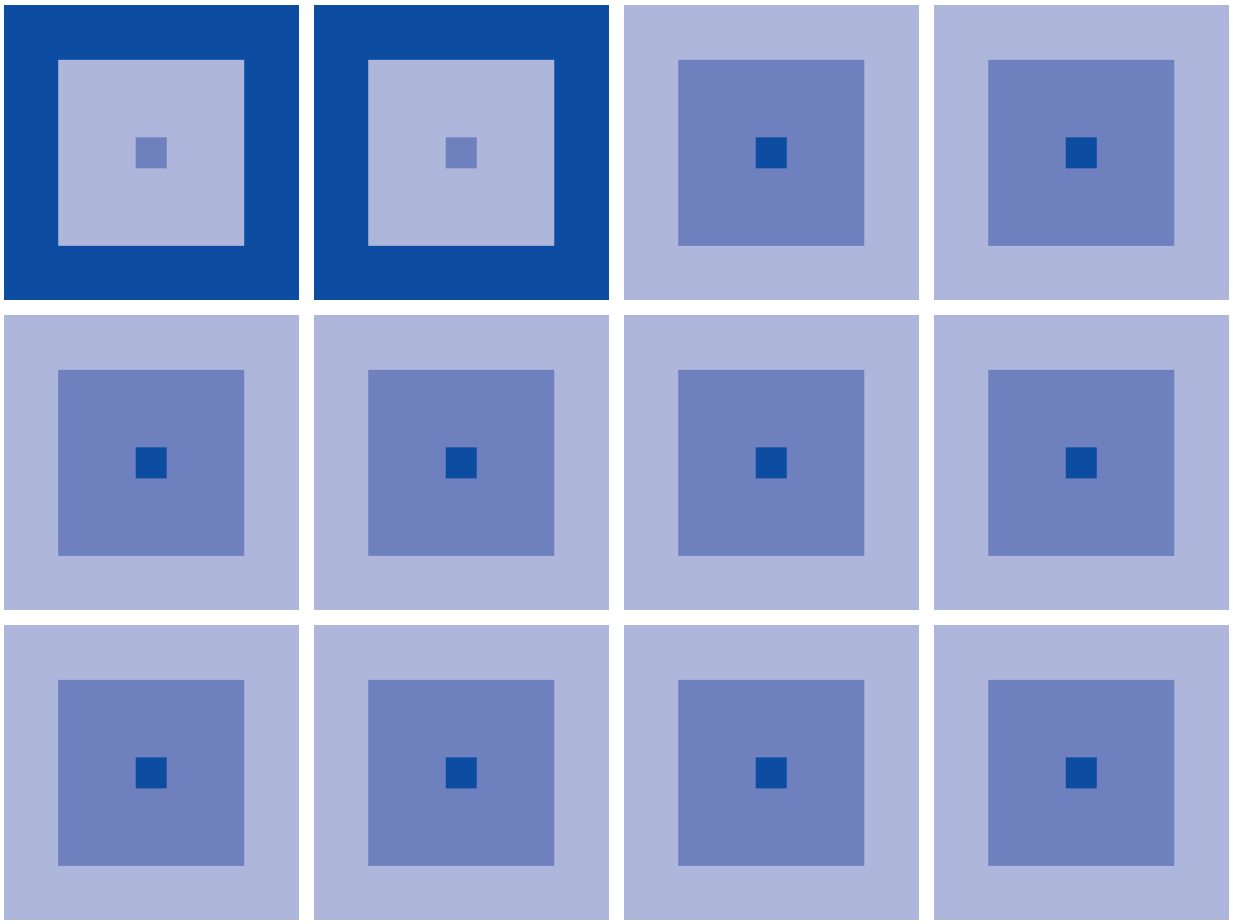
MF1161-02

EPSON

CMOS 4-BIT SINGLE CHIP MICROCOMPUTER

S5U1C6S3N2E2 Manual

(Evaluation Board for S1C60N09/6S3N2/62N33)



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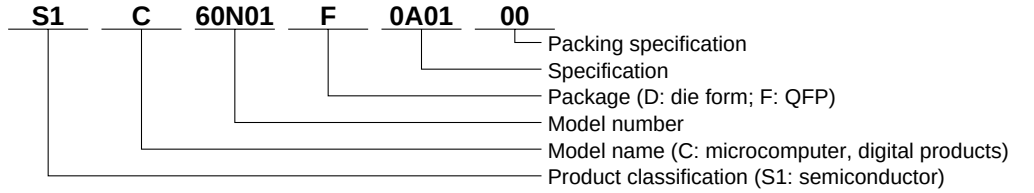
The information of the product number change

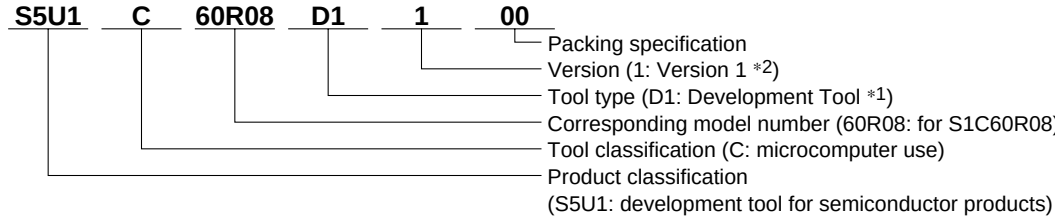
Starting April 1, 2001, the product number will be changed as listed below. To order from April 1, 2001 please use the new product number. For further information, please contact Epson sales representative.

Configuration of product number

Devices



Development tools



*1: For details about tool types, see the tables below. (In some manuals, tool types are represented by one digit.)
*2: Actual versions are not written in the manuals.

Comparison table between new and previous number

S1C60 Family processors

Previous No.	New No.
E0C6001	S1C60N01
E0C6002	S1C60N02
E0C6003	S1C60N03
E0C6004	S1C60N04
E0C6005	S1C60N05
E0C6006	S1C60N06
E0C6007	S1C60N07
E0C6008	S1C60N08
E0C6009	S1C60N09
E0C6011	S1C60N11
E0C6013	S1C60N13
E0C6014	S1C60140
E0C60R08	S1C60R08

S1C62 Family processors

Previous No.	New No.
E0C621A	S1C621A0
E0C6215	S1C62150
E0C621C	S1C621C0
E0C6S27	S1C6S2N7
E0C6S37	S1C6S3N7
E0C623A	S1C6N3A0
E0C623E	S1C6N3E0
E0C6S32	S1C6S3N2
E0C6233	S1C62N33
E0C6235	S1C62N35
E0C623B	S1C6N3B0
E0C6244	S1C62440
E0C624A	S1C624A0
E0C6S46	S1C6S460

Previous No.	New No.
E0C6247	S1C62470
E0C6248	S1C62480
E0C6S48	S1C6S480
E0C624C	S1C624C0
E0C6251	S1C62N51
E0C6256	S1C62560
E0C6292	S1C62920
E0C6262	S1C62N62
E0C6266	S1C62660
E0C6274	S1C62740
E0C6281	S1C62N81
E0C6282	S1C62N82
E0C62M2	S1C62M20
E0C62T3	S1C62T30

Comparison table between new and previous number of development tools

Development tools for the S1C60/62 Family

Previous No.	New No.
ASM62	S5U1C62000A
DEV6001	S5U1C60N01D
DEV6002	S5U1C60N02D
DEV6003	S5U1C60N03D
DEV6004	S5U1C60N04D
DEV6005	S5U1C60N05D
DEV6006	S5U1C60N06D
DEV6007	S5U1C60N07D
DEV6008	S5U1C60N08D
DEV6009	S5U1C60N09D
DEV6011	S5U1C60N11D
DEV60R08	S5U1C60R08D
DEV621A	S5U1C621A0D
DEV621C	S5U1C621C0D
DEV623B	S5U1C623B0D
DEV6244	S5U1C62440D
DEV624A	S5U1C624A0D
DEV624C	S5U1C624C0D
DEV6248	S5U1C62480D
DEV6247	S5U1C62470D

Previous No.	New No.
DEV6262	S5U1C62620D
DEV6266	S5U1C62660D
DEV6274	S5U1C62740D
DEV6292	S5U1C62920D
DEV62M2	S5U1C62M20D
DEV6233	S5U1C62N33D
DEV6235	S5U1C62N35D
DEV6251	S5U1C62N51D
DEV6256	S5U1C62560D
DEV6281	S5U1C62N81D
DEV6282	S5U1C62N82D
DEV6S27	S5U1C6S2N7D
DEV6S32	S5U1C6S3N2D
DEV6S37	S5U1C6S3N7D
EVA6008	S5U1C60N08E
EVA6011	S5U1C60N11E
EVA621AR	S5U1C621A0E2
EVA621C	S5U1C621C0E
EVA6237	S5U1C62N37E
EVA623A	S5U1C623A0E

Previous No.	New No.
EVA623B	S5U1C623B0E
EVA623E	S5U1C623E0E
EVA6247	S5U1C62470E
EVA6248	S5U1C62480E
EVA6251R	S5U1C62N51E1
EVA6256	S5U1C62N56E
EVA6262	S5U1C62620E
EVA6266	S5U1C62660E
EVA6274	S5U1C62740E
EVA6281	S5U1C62N81E
EVA6282	S5U1C62N82E
EVA62M1	S5U1C62M10E
EVA62T3	S5U1C62T30E
EVA6S27	S5U1C6S2N7E
EVA6S32R	S5U1C6S3N2E2
ICE62R	S5U1C62000H
KIT6003	S5U1C60N03K
KIT6004	S5U1C60N04K
KIT6007	S5U1C60N07K

S5U1C6S3N2E2 Manual (Evaluation Board for S1C60N09/6S3N2/62N33)

This manual describes how to operate the S5U1C6S3N2E2, a debugging tool for the S1C6S3N2, S1C62N33 and S1C60N09 4-bit single-chip microcomputers.

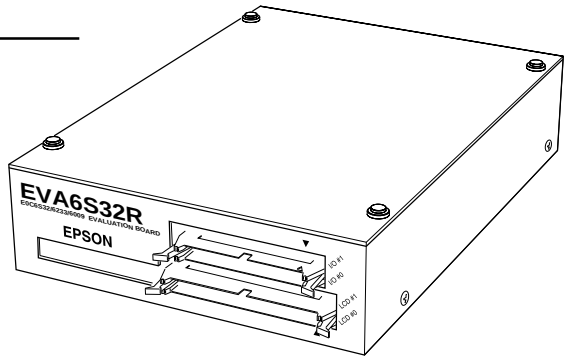
Refer to the Technical Manual of each model for details of the S1C6S3N2, S1C62N33 and S1C60N09, and the "S5U1C62000A Manual" and the "S5U1C62xxxD Manual" for the development procedure and other information.

CONTENTS

1 INTRODUCTION

1.1 S5U1C6S3N2E2 Outline

The S5U1C6S3N2E2 is a development tool for the S1C6S3N2, S1C62N33 and S1C60N09.
Most of the same functions that the S1C6S3N2/62N33/60N09 CPU has can be implemented by writing an application program and by creating option data with the function and segment option generators into EPROMs, and then installing them in the S5U1C6S3N2E2. (The model to be evaluated can be switched using the DIP switch on the S5U1C6S3N2E2 board.)



* The name 'EVA6S32R' on the development tool is the old name of the product.

In addition, the S5U1C6S3N2E2 can interface with the in-circuit emulator ICE (S5U1C62000H), and so perform a higher level of debugging. The set-up data for each option can be loaded from a PC.

1.2 S5U1C6S3N2E2 Components

When unpacking the S5U1C6S3N2E2, make sure all of the following components are included.

(1) S5U1C6S3N2E2 main unit 1
(2) LCD connection cable and connector (60-pin flat type) ..... 1 set
(3) I/O connection cable and connector (50-pin flat type) ..... 1 set
(4) Power cable (3-pin) ..... 1 set
(5) Fuse (3 A) 1
(6) S5U1C6S3N2E2 Manual (Evaluation Board for S1C60N09/6S3N2/62N33) (this manual) 1
(7) Warranty registration card 1
(8) Warranty certificate 1
(9) Notes on use 1

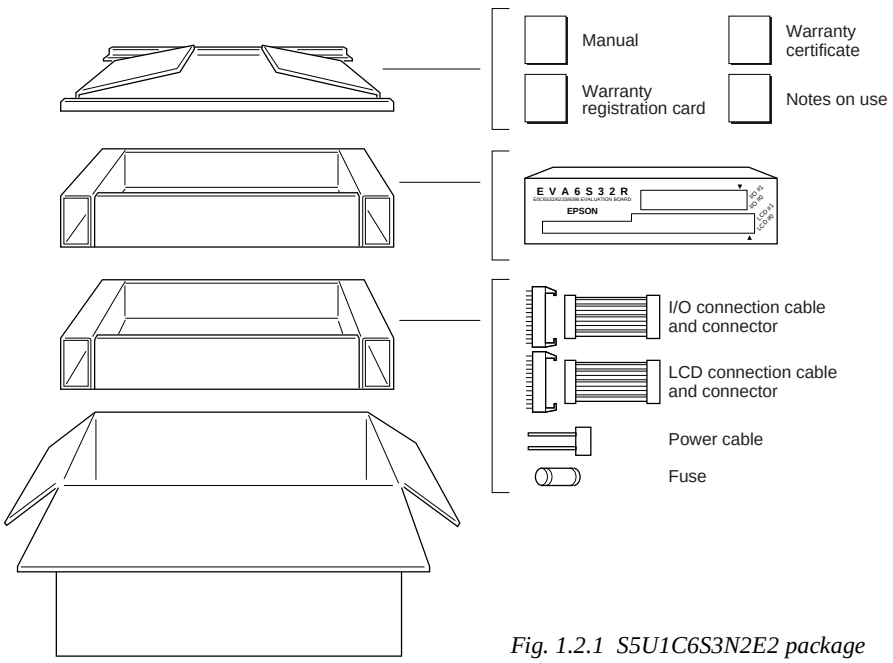


Fig. 1.2.1 S5U1C6S3N2E2 package

2 PRODUCT SPECIFICATIONS

The components specifications of the S5U1C6S3N2E2 are listed below.

■ S5U1C6S3N2E2

Dimensions:	203 mm (width) × 275 mm (depth) × 65 mm (height) (Including rubber feet)		
Weight:	About 2 kg		(main unit only)
Color:	Cygnus white		
Power supply:	5 V (±10%) DC, 3 A or more		(from external power supply)
	When connected to the ICE, power is supplied by the ICE.		
Board:	Main board × 1		
	Sub board × 1		
Operating conditions:	Operating temperature	5°C to 40°C	
	Storage temperature	-20°C to 60°C	
	Operating humidity	35% to 80%	
	Storage humidity	20% to 90%	
	Resistance to vibration	Operating	0.25G max.
		Transportation	2G max.
	Resistance to impulse	Operating	1G max.
		Standby	2G max.

■ LCD connection cable (supplied with S5U1C6S3N2E2)

S5U1C6S3N2E2 connector:	J3372-P302VE (3M) or equivalent
Cable connector:	7960-6500SC (3M)
Cable:	60-pin flat cable × 1
Interface:	CMOS interface (5 V)
Length:	About 50 cm

■ I/O cable (supplied with S5U1C6S3N2E2)

S5U1C6S3N2E2 connector:	J3433-P302VE (3M) or equivalent
Cable connector:	7950-6500SC (3M)
Cable:	50-pin flat cable × 1
Interface:	CMOS interface (5 V)
Length:	About 50 cm

■ Power cable (supplied with S5U1C6S3N2E2)

S5U1C6S3N2E2 connector:	MOLEX 5276-03A or equivalent
Cable connector:	MOLEX 5196-03
Other side connector:	(According to power supply specifications)
Cable length:	About 80 cm
Capacity:	5 V DC, 3 A or more

■ Accessories

Fuse type / rating:	MGC-ULCSA 125V 3 A × 1	
60-pin connector for connecting to target system:		
	3432-6002LCSC × 1	(For LCD cable connection)
50-pin connector for connecting to target system:		
	3433-6002LCSC × 1	(For I / O cable connection)

■ EPROM

For programs:	Intel i27C64–i27C512 or equivalent	2	(Access time 250 ns or less)
For function option:	Intel i27C64–i27C512 or equivalent	1	(Access time 250 ns or less)
For segment option:	Intel i27C64–i27C512 or equivalent	1	(Access time 250 ns or less)

3 NAMES AND FUNCTIONS OF PARTS

This section describes the names and functions of the parts of the S5U1C6S3N2E2.

3.1 Basic Functions

The S5U1C6S3N2E2 has the following basic functions:

■ Program execution (Run function)

Install the EPROM containing the application program and execute the program.

■ Interface with ICE

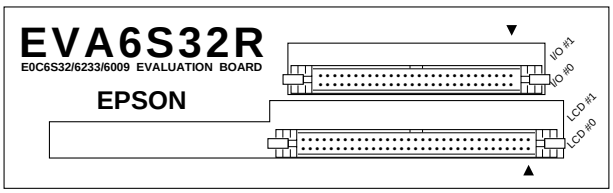
The S5U1C6S3N2E2 can interface with the ICE so that a higher level debugging environment may be established.

■ Setting hardware options by installing function option and segment option ROMs

Hardware options, i.e., I/O ports and LCD segments, can be specified by writing option data for the function option created by the function option generator and the segment option created by the segment option generator into EPROM, and installing it to the S5U1C6S3N2E2.

3.2 Functions of Parts

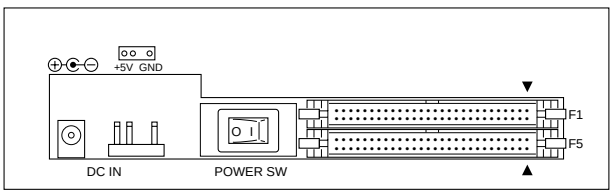
3.2.1 Front panel



▲ Position of pin 1

Fig. 3.2.1.1 Front panel

3.2.2 Rear panel



▲ Position of pin 1

Fig. 3.2.2.1 Rear panel

Note: Be sure to disconnect external power source before connection with the ICE, because power is supplied from the ICE when the S5U1C6S3N2E2 is connected to the ICE.

■ Connectors

- **I/O #0**
  Connector for the I/O cable. The I/O cable is used to connect the S5U1C6S3N2E2 to the target system.
- **LCD #0**
  Connector for the LCD cable. The LCD cable is used to connect the S5U1C6S3N2E2 to the target system.

■ Switch

- **POWER SW**
  This is a switch to turn on or off the external power supply to the S5U1C6S3N2E2. (Turn off the POWER switch when the ICE is connected.)

■ Connectors

- **DC IN 5 V**
  This is a connector with external power supply source. The external power supply should be in direct current of 5 V for 3 A or more.
- **F1, F5**
  Connectors for the ICE interface cable.

3.2.3 Board (under top cover)

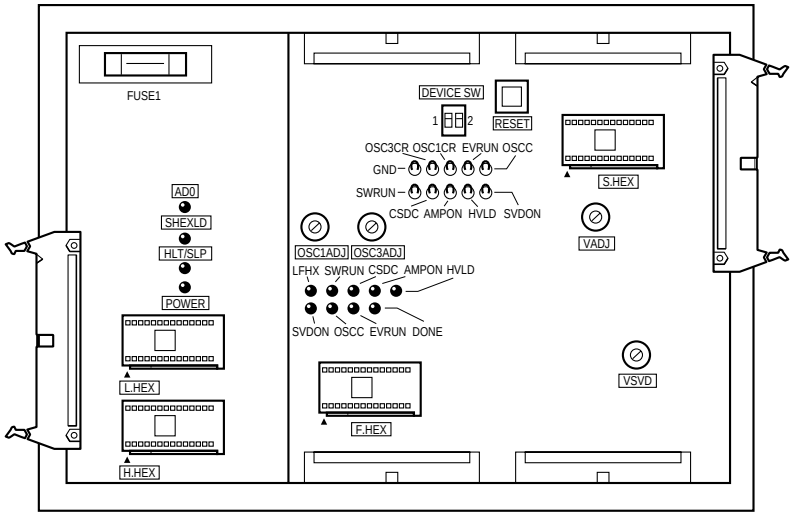


Fig. 3.2.3.1 Layout on the board

■ ROM sockets

- **L.HEX, H.HEX**
  These are IC sockets for target program ROMs. Insert the ROM (L.HEX) containing the 8 low-order bits (I7 to I0) of the machine code into the L.HEX socket, and the ROM (H.HEX) containing the 4 high-order bits (IB to I8) into the H.HEX socket.
- **F.HEX**
  This is the IC socket into which the ROM (F.HEX) is inserted. This ROM includes the function options generated by the function option generator.
- **S.HEX**
  This is the IC socket into which the ROM (S.HEX) is inserted. This ROM includes the segment options generated by the segment option generator.

■ Switch

- **RESET switch**
  This switch resets the CPU and starts the target program from page 01H, step 00H.
- **DEVICE SW** (DIP switch)
  This switch is used to select the model (S1C6S3N2, S1C62N33 or S1C60N09) to be evaluated. Table 3.2.3.1 shows the correspondence between the model and the switch settings.

Table 3.2.3.1 Selecting the model

Model	SW1	SW2
S1C6S3N2	ON	ON
S1C62N33	OFF	ON
S1C60N09	ON	OFF

■ Control

- **VADJ**
  This is the control for adjusting the LCD contrast.
  (Refer to Section 6.2, "Differences from Actual IC".)
- **VSVD** (can be used only when the S5U1C6S3N2E2 is set for the S1C6S3N2 or the S1C62N33)
  This is the control for varying the power supply voltage in simulation to check SVD (BLD) operation.
  (Refer to Section 6.2, "Differences from Actual IC".)

- **OSC1ADJ** (can be used only when the S5U1C6S3N2E2 is set for the S1C60N09)
  OSC3ADJ (can be used only when the S5U1C6S3N2E2 is set for the S1C6S3N2 or the S1C62N33)
  This is the control for varying the CR oscillation frequency. This control is effective only when CR oscillation is selected for the oscillator type by mask option. The CR oscillation frequency can be checked by connecting an oscilloscope or other instrument to the monitor pin (OSC1CR, OSC3CR).

■ FUSE

- **FUSE1**
  This is 3 A tubular fuse for external power supply, and is blown off by current of 3 A or more.

■ LEDs

- **POWER**
  This LED lights when the S5U1C6S3N2E2 turns on.
- **HLT/SLP**
  This LED lights when the CPU enters HALT status.
- **AD0**
  This LED indicates the status of the address bit 0 (AD0) of the program memory. It can be used to check whether or not the S5U1C6S3N2E2 is in the free run status.
- **SHEXLD**
  This LED lights when LCD segment option data from a personal computer is loaded using the in-circuit emulator ICE. As result, it can differentiate whether the currently specified segment option is due to the ROM (-S.HEX) or has been loaded from a personal computer. Refer to the "S5U1C62000A Manual" in regard to the loading of the segment option using the ICE.
- **LFHX**
  This LED lights when function option data from a personal computer is loaded using the in-circuit emulator ICE. As result, it can differentiate whether the currently specified function option is due to the ROM (-F.HEX) or has been loaded from a personal computer. Refer to the "S5U1C62000A Manual" in regard to the loading of the function option using the ICE.
- **DONE/PG**
  This LED lights when initial reset of this board has been completed after the S5U1C6S3N2E2 is turned on.
- **HVLD, SVDON*, OSCC*, AMPON*, CSDC, SWRUN, EVRUN***
  These LEDs indicate the values ("1" or "0") of the following resisters. LED lights when "1" is set in the resister, and it goes off when "0" is set to the resister.

HVLD	HVLD (HLMOD) register	(076H • D3)
SVDON*	SVDON (BLS) register	(076H • D2)
OSCC*	OSCC register	(0FEH • D1)
AMPON*	AMPON register	(0F7H • D0)
CSDC	CSDC register	(078H • D3)
SWRUN	SWRUN register	(07EH • D2)
EVRUN*	EVRUN register	(0FCH • D2)

■ Monitor pins

The value of the HVLD (HLMOD), SVDON (BLS)*, OSCC*, AMPON*, CSDC, SWRUN and EVRUN* registers can be checked by an oscilloscope or other instrument. GND can be used to connect the GND pin of an oscilloscope.

* Effective only when the S5U1C6S3N2E2 is set for the S1C6S3N2 or the S1C62N33.

3.3 S5U1C6S3N2E2 I/O and LCD Connectors

S1C6S3N2

Table 3.3.1 I/O #0 connector pins

No.	Signal name	No.	Signal name
1	VDD (+5 V)	2	VDD (+5 V)
3	VDD (+5 V)	4	VDD (+5 V)
5	Cannot be connected	6	Cannot be connected
7	K00	8	K01
9	K02	10	K03
11	K10	12	Cannot be connected
13	Cannot be connected	14	Cannot be connected
15	Cannot be connected	16	Cannot be connected
17	Cannot be connected	18	Cannot be connected
19	P00	20	P01
21	P02	22	P03
23	P10	24	P11
25	P12	26	P13
27	Cannot be connected	28	Cannot be connected
29	R00	30	R01
31	R02	32	R03
33	R10	34	R11
35	R12	36	R13
37	Cannot be connected	38	Cannot be connected
39	Cannot be connected	40	Cannot be connected
41	Cannot be connected	42	Cannot be connected
43	Cannot be connected	44	RESET
45	AMPP	46	AMPM
47	VSS (GND)	48	VSS (GND)
49	VSS (GND)	50	VSS (GND)

Table 3.3.2 LCD #0 connector pins

No.	Signal name	No.	Signal name
1	COM0	2	COM1
3	COM2	4	COM3
5	Cannot be connected	6	Cannot be connected
7	Cannot be connected	8	Cannot be connected
9	SEG0	10	SEG1
11	SEG2	12	SEG3
13	SEG4	14	SEG5
15	SEG6	16	SEG7
17	SEG8	18	SEG9
19	SEG10	20	SEG11
21	SEG12	22	SEG13
23	SEG14	24	SEG15
25	SEG16	26	SEG17
27	SEG18	28	SEG19
29	SEG20	30	SEG21
31	SEG22	32	SEG23
33	SEG24	34	SEG25
35	SEG26	36	SEG27
37	SEG28	38	SEG29
39	SEG30	40	SEG31
41	SEG32	42	SEG33
43	SEG34	44	SEG35
45	SEG36	46	SEG37
47	Cannot be connected	48	Cannot be connected
49	Cannot be connected	50	Cannot be connected
51	Cannot be connected	52	Cannot be connected
53	Cannot be connected	54	Cannot be connected
55	Cannot be connected	56	Cannot be connected
57	Cannot be connected	58	Cannot be connected
59	Cannot be connected	60	Cannot be connected

S1C62N33

Table 3.3.3 I/O #0 connector pins

No.	Signal name	No.	Signal name
1	VDD (+5 V)	2	VDD (+5 V)
3	VDD (+5 V)	4	VDD (+5 V)
5	Cannot be connected	6	Cannot be connected
7	K00	8	K01
9	K02	10	K03
11	K10	12	Cannot be connected
13	Cannot be connected	14	Cannot be connected
15	Cannot be connected	16	Cannot be connected
17	Cannot be connected	18	Cannot be connected
19	P00	20	P01
21	P02	22	P03
23	P10	24	P11
25	P12	26	P13
27	Cannot be connected	28	Cannot be connected
29	R00	30	R01
31	R02	32	R03
33	R10	34	R11
35	R12	36	R13
37	Cannot be connected	38	Cannot be connected
39	SIN	40	SOUT
41	SCLK	42	SIOF
43	Cannot be connected	44	RESET
45	AMPP	46	AMPM
47	VSS (GND)	48	VSS (GND)
49	VSS (GND)	50	VSS (GND)

Table 3.3.4 LCD #0 connector pins

No.	Signal name	No.	Signal name
1	COM0	2	COM1
3	COM2	4	COM3
5	Cannot be connected	6	Cannot be connected
7	Cannot be connected	8	Cannot be connected
9	SEG0	10	SEG1
11	SEG2	12	SEG3
13	SEG4	14	SEG5
15	SEG6	16	SEG7
17	SEG8	18	SEG9
19	SEG10	20	SEG11
21	SEG12	22	SEG13
23	SEG14	24	SEG15
25	SEG16	26	SEG17
27	SEG18	28	SEG19
29	SEG20	30	SEG21
31	SEG22	32	SEG23
33	SEG24	34	SEG25
35	SEG26	36	SEG27
37	SEG28	38	SEG29
39	SEG30	40	SEG31
41	SEG32	42	SEG33
43	SEG34	44	SEG35
45	SEG36	46	SEG37
47	SEG38	48	SEG39
49	Cannot be connected	50	Cannot be connected
51	Cannot be connected	52	Cannot be connected
53	Cannot be connected	54	Cannot be connected
55	Cannot be connected	56	Cannot be connected
57	Cannot be connected	58	Cannot be connected
59	Cannot be connected	60	Cannot be connected

S1C60N09

Table 3.3.5 I/O #0 connector pins

No.	Signal name	No.	Signal name
1	VDD (+5 V)	2	VDD (+5 V)
3	VDD (+5 V)	4	VDD (+5 V)
5	Cannot be connected	6	Cannot be connected
7	K00	8	K01
9	K02	10	K03
11	Cannot be connected	12	Cannot be connected
13	Cannot be connected	14	Cannot be connected
15	Cannot be connected	16	Cannot be connected
17	Cannot be connected	18	Cannot be connected
19	P00	20	P01
21	P02	22	P03
23	P10	24	P11
25	P12	26	P13
27	Cannot be connected	28	Cannot be connected
29	R00	30	R01
31	R02	32	R03
33	Cannot be connected	34	Cannot be connected
35	Cannot be connected	36	Cannot be connected
37	Cannot be connected	38	Cannot be connected
39	Cannot be connected	40	Cannot be connected
41	Cannot be connected	42	Cannot be connected
43	Cannot be connected	44	RESET
45	Cannot be connected	46	Cannot be connected
47	VSS (GND)	48	VSS (GND)
49	VSS (GND)	50	VSS (GND)

Table 3.3.6 LCD #0 connector pins

No.	Signal name	No.	Signal name
1	COM0	2	COM1
3	COM2	4	COM3
5	Cannot be connected	6	Cannot be connected
7	Cannot be connected	8	Cannot be connected
9	SEG0	10	SEG1
11	SEG2	12	SEG3
13	SEG4	14	SEG5
15	SEG6	16	SEG7
17	SEG8	18	SEG9
19	SEG10	20	SEG11
21	SEG12	22	SEG13
23	SEG14	24	SEG15
25	SEG16	26	SEG17
27	SEG18	28	SEG19
29	SEG20	30	SEG21
31	SEG22	32	SEG23
33	SEG24	34	SEG25
35	SEG26	36	SEG27
37	SEG28	38	SEG29
39	SEG30	40	SEG31
41	SEG32	42	SEG33
43	SEG34	44	SEG35
45	SEG36	46	SEG37
47	Cannot be connected	48	Cannot be connected
49	Cannot be connected	50	Cannot be connected
51	Cannot be connected	52	Cannot be connected
53	Cannot be connected	54	Cannot be connected
55	Cannot be connected	56	Cannot be connected
57	Cannot be connected	58	Cannot be connected
59	Cannot be connected	60	Cannot be connected

Note: Do not use pins that cannot be connected.

4 CABLE CONNECTION

This section describes how to connect the power cable to the S5U1C6S3N2E2, and the S5U1C6S3N2E2 to the ICE and the target system.

Note: Turn the power of all equipment off before connecting or disconnecting cables.

4.1 Connection to ICE

The S5U1C6S3N2E2 is connected to the ICE by connecting the two interface cables (F1 and F5). Use S5U1C6S3N2E2 connectors F1 and F5 with the projections facing outwards. Use ICE connectors F1 and F5 with the projections facing inwards (cable side).
Figures 4.1.1 and 4.1.2 show the external view and connection diagram of the ICE interface cable.

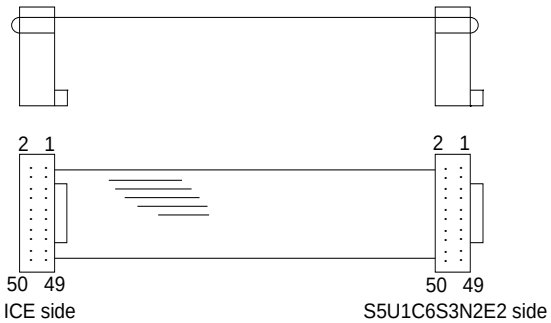


Fig. 4.1.1 External view of the ICE interface cable

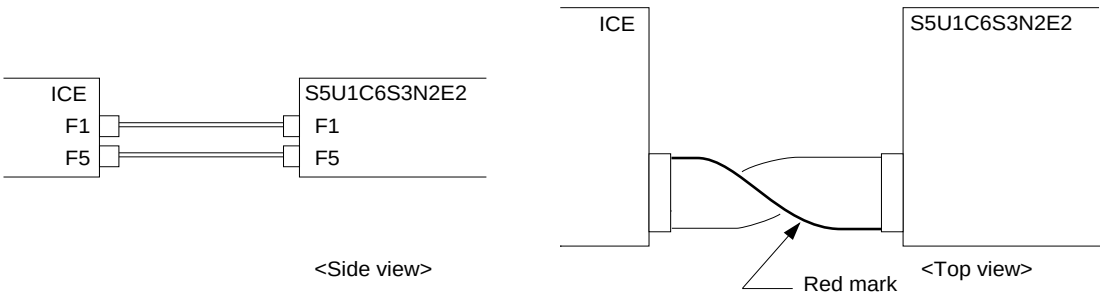


Fig. 4.1.2 Connection diagram

Note: The S5U1C6S3N2E2 has an external power input connector for +5 V (V_{DD}) and GND (V_{SS}). Leave this connector unconnected when the S5U1C6S3N2E2 is connected to the ICE.

4.2 Power Cable Connection

When using the S5U1C6S3N2E2 on its own, it must be supplied with power (5 V DC, 3 A or more) from an external source through the power cable.
When the S5U1C6S3N2E2 is connected to the ICE, the power is supplied by the ICE; therefore, the power cable is not necessary. Disconnect the power cable if it is already connected.
Figure 4.2.1 shows the connection of the power cable pins.

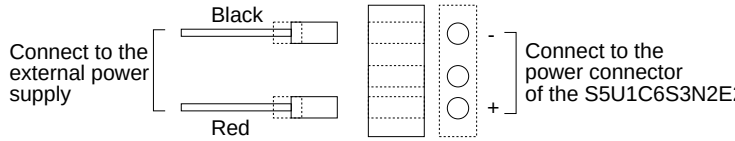


Fig. 4.2.1 Connection of power cable pins

In addition, the power can be supplied from the DC jack (DCIN). The AC adaptor provided with the ICE can be used.

Note: Be sure to use only one power source either the AC adaptor or the power cable for independent use of the S5U1C6S3N2E2. Do not connect the AC adaptor and the power cable when using the S5U1C6S3N2E2 with the ICE.

4.3 Connection to Target System

The I/O #0 and LCD #0 connectors are used to connect the S5U1C6S3N2E2 to the target system.

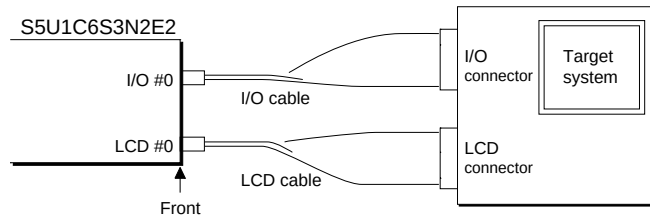


Fig. 4.3.1 Connection of target system

Take the following precautions when connecting the S5U1C6S3N2E2 to the target system:
- Power is supplied to the S5U1C6S3N2E2, unlike the actual chip.
- Do not use pins that cannot be connected.

5 OPERATION METHOD OF S5U1C6S3N2E2

5.1 Preparation

This section describes the common preparation work necessary when the S5U1C6S3N2E2 is used by itself and when it is connected to the ICE.
Before doing the following, be sure to turn the POWER switch of the S5U1C6S3N2E2 off.

5.1.1 Creation of target system

Mount the LCD panel, keys, and switches on the board to build a target system. Use the I/O connector and LCD connector supplied with the S5U1C6S3N2E2 to connect the S5U1C6S3N2E2 to the target system. (For the pin layout of each connector, refer to Section 3.3, "S5U1C6S3N2E2 I/O and LCD Connectors".)

Note: There is some difference in specifications between the S5U1C6S3N2E2 and the actual CPU. Refer to Section 6.2, "Differences from Actual IC" when building a target system.

5.1.2 Creation and installation of ROMs

Create the program ROMs, function option ROM and segment option ROM, and insert them into the sockets of the S5U1C6S3N2E2.

- **Program ROMs (two)**

  The program ROMs contain the application program machine code. Write the Intel-HEX format files output by the HEX converter or the cross-assembler into EPROMs to create program ROMs. Since two HEX files containing the high-order section (-H.HEX) and the low-order section (-L.HEX) of the machine code are output, two EPROMs are created. Insert them into the socket H.HEX and L.HEX under the top cover, respectively.
  These ROMs are not effective when connecting the S5U1C6S3N2E2 to the ICE. In addition, it is necessary to write the object data into the EPROM attaching the offset address as Table 5.1.2.1 according to the type of EPROM to be used.

Table 5.1.2.1 Offset address

EPROM type	Offset value
27C64	0000H (no offset)
27C128	0000H (no offset)
27C256	4000H
27C512	C000H

- **Function option ROM (one)**

  The function option ROM is used to specify function options, such as I/O port specifications. Create the function option ROM from the function option HEX file (-F.HEX) output by the function option generator, and insert it into the F.HEX socket under the top cover.
  This ROM is effective even when the ICE is connected, however, this ROM is disregarded due to the loading of the data from the ICE.

- **Segment option ROM (one)**

  The segment option ROM is used to specify segment options for LCD assignment and SEG terminal output specifications. Create the segment option ROM from the segment option HEX file (-S.HEX) output by the segment option generator, and insert it into the S.HEX socket in the top cover.
  This ROM is effective even when the ICE is connected, however, this ROM is disregarded due to the loading of the data from the ICE.

- **EPROM specifications**

  Use EPROMs with the following specifications:

  Program ROM: 27C64 to 27C512 (250 ns or less access time)
  Function option ROM: 27C64 to 27C512 (250 ns or less access time)
  Segment option ROM: 27C64 to 27C512 (250 ns or less access time)

5.2 Independent Use of S5U1C6S3N2E2

This section describes operation when using the S5U1C6S3N2E2 by itself.
The S5U1C6S3N2E2 may be used independently by connecting a power supply to it. Use a 5 V DC regulator (more than 3 A) or the AC adaptor supplied with the ICE as an external power supply. When using an external power supply, connect it with the correct polarity (+ and -).
(Refer to Section 4.2, "Power Cable Connection".)

5.2.1 Power on/off

Before turning the POWER switch of the S5U1C6S3N2E2 on, confirm the following:
(1) The power cable is connected correctly.
(2) The target system is connected correctly.
(3) The ROMs have been installed correctly.

After confirming the above items, turn the POWER switch of the S5U1C6S3N2E2 on using the following procedure. When turning the S5U1C6S3N2E2 off, follow the procedure from (2) to (1):
(1) Turn the regulator on and set the output voltage to 5 V ±10%.
When using the AC adaptor, plug the AC adaptor into the AC line and the S5U1C6S3N2E2.
(2) Turn the POWER switch of the S5U1C6S3N2E2 on.

5.2.2 Debugging

When the S5U1C6S3N2E2 is used alone, it provides the following debugging function. The method of operation is given below.

- **Program free run**
  When the RESET switch (under the top cover) is pressed, the S5U1C6S3N2E2 enters the program run state, and executes the application program from page 1, step 0.
- **Other functions**
  The SVD operation can be confirmed with the VSVD control.*
  The LCD contrast can be adjusted with the VADJ control. (Refer to Section 6.2, "Differences from Actual IC".)
  The HVLD (HLMOD), SVDON (BLS)*, OSCC*, AMPON*, CSDC, SWRUN and EVRUN* resister values can be confirmed with the LED indicators and the monitor pins.

  * These functions can be used when the S5U1C6S3N2E2 is set for the S1C6S3N2 or the S1C62N33.

5.3 Operation When ICE is Connected

This section explains the operation and use of the S5U1C6S3N2E2 when it is connected to the ICE. Set up the S5U1C6S3N2E2 as follows when it is connected to the ICE:

(1) Do not connect the power supply and the AC adaptor.
(2) Keep on turning the POWER switch off.

5.3.1 Power on/off

Power to the S5U1C6S3N2E2 is supplied by the ICE, and the power is switched on and off by pressing the POWER switch of the ICE. Keep the POWER switch of the S5U1C6S3N2E2 off.

5.3.2 Debugging

Debugging is done with the host computer, and the S5U1C6S3N2E2 is controlled by the ICE. For the method of operation, refer to the "S5U1C62000A Manual" and the "S5U1C62xxxD Manual". The S5U1C6S3N2E2 can control the following three functions:
(1) Pseudo power supply voltage change with the VSVD control *
(2) LCD contrast adjustment with the VADJ control
(3) RESET switch

* This function can be used when the S5U1C6S3N2E2 is set for the S1C6S3N2 or the S1C62N33.

6 PRECAUTIONS

Take the following precautions when using the S5U1C6S3N2E2:

6.1 Precautions for Operation

- Turn the power of all equipment off before connecting or disconnecting cables.
- When ROMs are inserted into the ROM sockets L, H, lock the lever securely by positioning it horizontally. After the ROMs have been removed from the sockets, lock the lever at the same position above. If the lever is left upright, poor contact may result.
- When using the S5U1C6S3N2E2 by itself, confirm that the following ROMs have been installed correctly, then operate the S5U1C6S3N2E2.

Program ROMs	2	L.HEX, H.HEX
Function option ROM	1	F.HEX
Segment option ROM	1	S.HEX

6.2 Differences from Actual IC

Be aware that the S5U1C6S3N2E2 differs in terms of functionality and characteristics from the actual IC. If these differences are ignored, there is a possibility that the application will not operate properly on an actual IC even though it might have performed well on the ICE.

Note: The functions indicated with an "∗" in the following explanation can be used when the S5U1C6S3N2E2 is set for the S1C6S3N2 or the S1C62N33.

■ Core CPU

The S5U1C6S3N2E2 supports the three models, S1C6S3N2, S1C62N33 and S1C60N09. Since each model has a different core CPU built-in, there is a difference as shown in the following table.
When developing the software for the S1C62N33,

- be sure to initialize the D flag by the initial routine in the application program,
- do not read interrupt factor flags and do not write data to the interrupt mask register in the EI status.

Table 6.2.1 Difference on core CPU function

Model	S5U1C6S3N2E2	S1C6S3N2	S1C62N33	S1C60N09
Core CPU	S1C6200A	S1C6200A	S1C6200	S1C6200B
Initial value of D flag	0	0	Undefined	0
Reading interrupt factor flags, writing to the interrupt mask register in the EI status	Valid	Valid	Invalid	Valid

∗ There is no difference in the functions of the S1C6200A and S1C6200B.

■ I/O

<Interface voltage>

The interface voltage between the S5U1C6S3N2E2 and the target system is fixed at +5 V. Therefore, if the target system requires the same interface voltage as that of the actual IC, add a level shifter circuit or some other appropriate circuit to the target system.

<Output port drive capability>

The drive capability of each output port on the S5U1C6S3N2E2 is higher than that of the actual IC. Check the drive capability of each output terminal on the model by referring to its Technical Manual before designing the system and software.

<Protective diode at each port>

The S5U1C6S3N2E2 I/O ports are all connected to VDD and VSS through a protective diode and the interface voltage with the target system is fixed at +5 V. Therefore, the ports cannot interface with a voltage level exceeding VDD–VSS even when the output specification is set to open-drain output.

<Pull-down resistance>

The K ports of the S5U1C6S3N2E2 have a 1 MΩ pull-down resistor and the P ports have a 200 kΩ pull-down resistor which are different from those of the actual IC. For the resistor value of the actual IC, refer to the Technical Manual for each model.

The set-up time when the input port is pulled down to low with the pull-down resistor is different from the actual IC. For example, when a key matrix circuit is configured with input and output ports, a delay occurs in the input fall time by the pull-down resistor. Note that the delay time between the S5U1C6S3N2E2 and the actual IC is not same.

■ LCD

- The S5U1C6S3N2E2 has the VADJ control for adjusting the LCD contrast. In the actual IC, the LCD drive voltage level is fixed.
- The S5U1C6S3N2E2 can output 1/3-bias waveforms only, and cannot output 1/2-bias waveforms.
- The output drive capability of the SEG and COM terminals is different.
- When a SEG terminal is set to DC output, the output level is not be initialized in the S5U1C6S3N2E2. However, it is initialized in the S1C6S3N2 and S1C60N09. In the S1C62N33, it is not initialized similar to the S5U1C6S3N2E2, but the undefined status is different from the S5U1C6S3N2E2.

■ Difference in current consumption

Current consumption in the S5U1C6S3N2E2 greatly differs from that in the actual IC. To evaluate the approximate current consumption of the actual IC, check the LEDs on the S5U1C6S3N2E2. The following lists the items that greatly affect the amount of current consumption:

- Those that can be estimated by checking LEDs and monitor pins
  a) Run and Halt execution ratio (on the ICE)
  b) AMP operation (AMPON)*
  c) OSC3 oscillation ON/OFF circuit (OSCC)*
  d) SVD circuit ON/OFF circuit (SVDON or BLS)*
  e) Heavy load protection mode (HVLD or HLMOD)
- Those that require attention during system and software design
  f) Currents consumed by the internal pull-down resistors
  g) Input ports in a floating state

■ Functional difference

<SVD (BLD) circuit>*

- The SVD (BLD) function is implemented by varying the apparent power supply voltage with the VSVD volume on the S5U1C6S3N2E2 board.
- There is a delay between the time change the power supply voltage and the SVD (BLD) data is detected. For the S5U1C6S3N2E2, it is shorter than the actual IC. For the actual IC, refer to the Technical Manual of each model and detect the voltage after the sufficient time interval.

<AMP circuit>*

There is a delay between the time change the voltage of the AMP pins and the AMP data is detected. For the S5U1C6S3N2E2, it is shorter than the actual IC. For the actual IC, refer to the Technical Manual of each model and choose the sufficient time interval.

<Oscillation circuit>

- The oscillation circuits in the S5U1C6S3N2E2 and the oscillation frequencies are configured according to the selected model as follows:

  When the S5U1C6S3N2E2 is set for the S1C6S3N2:
  The OSC1 oscillation frequency is fixed at 32.768 kHz with a crystal oscillator.
  The OSC3 oscillation frequency is fixed at 1 MHz when ceramic oscillation is selected. When CR oscillation is selected, the frequency can be adjusted approximately from 700 kHz to 1.3 MHz.

  When the S5U1C6S3N2E2 is set for the S1C62N33:
  The OSC1 oscillation frequency is fixed at 32.768 kHz with a crystal oscillator.
  The OSC3 oscillation frequency is fixed at 455 kHz when ceramic oscillation is selected. When CR oscillation is selected, the frequency can be adjusted approximately from 300 kHz to 560 kHz.

  When the S5U1C6S3N2E2 is set for the S1C60N09:
  The OSC1 oscillation frequency is fixed at 32.768 kHz when crystal oscillation is selected. When CR oscillation is selected, the frequency can be adjusted approximately from 44 kHz to 85 kHz.

  Refer to the Technical Manual of each model for the operating frequency range of the actual IC.

- The oscillation stabilization time for OSC3 and OSC1 is shorter than the actual IC. The time from turning the OSC3 oscillation on to switching the system clock to OSC3 should be secured according to the time of the actual IC. *
- Use separate instructions for turning the OSC3 oscillation on and for switching the clock from OSC1 to OSC3. The same applies when turning the OSC1 oscillation off after switching the clock from OSC3 to OSC1. The S5U1C6S3N2E2 may operate if this processing is performed at the same time. Be sure to use separate instructions according to the actual IC when creating the program. *
- The oscillation start and stop times are different from those of the actual IC, because the logic level of the S5U1C6S3N2E2 is higher than that of the actual IC.

<Waiting time>

The actual IC requires an appropriate waiting time for the operation of the following functions, but the S5U1C6S3N2E2 may operate properly without the waiting time. Therefore, it may cause a malfunction in the actual IC even though the program operates properly in the S5U1C6S3N2E2. Be sure to follow the notes described in the Technical Manual of each model.

SVD function	(SVDON or BLS)*
AMP function	(AMPON)*

<Undefined data memory area>

In the S5U1C6S3N2E2, values that are read from unmapped memory areas will be undefined. However, the undefined status differs from the actual IC, therefore pay attention to the memory area when creating programs. Refer to the Technical Manual of each model for the memory map.

<Reset circuit>

- The S5U1C6S3N2E2 does not contain an oscillation stop detection circuit (to generate a system reset signal when the oscillation has stopped). Note that the oscillation stop detection circuit can not guarantee operation with 100% accuracy.
- The sequence of operations from when the S5U1C6S3N2E2 is turned on until the program starts operating is different from the actual IC. The S5U1C6S3N2E2 can start executing the program after the user program and option data are loaded on the S5U1C6S3N2E2.

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S5U1C6S3N2E2 Manual
(Evaluation Board for S1C60N09/6S3N2/62N33)

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